Performance, Agility, and Cost of Cloud Computing Services for NASA GES DISC Giovanni Application

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The performance, agility and cost of Giovanni on Cloud platform are investigated and compared with local legacy server system.

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Introduction

The NASA Goddard Earth Science Data and Information Services Center (GES DISC) is investigating the performance, agility and cost of Cloud computing for GES DISC applications. Giovanni (Geospatial Interactive Online Visualization ANd aNalysis Infrastructure), one of the core applications at the GES DISC for online climate-related Earth science data access, subsetting, analysis, visualization, and downloading, was used to evaluate the feasibility and effort of porting an application to the Amazon Cloud platform. The performance and the cost of running Giovanni on the Amazon Cloud platform were compared to similar parameters for the GES DISC local operating system. A comparison scenario was designed with a time series analysis of aerosol absorption optical depth (388nm) from OMI/Aura.

The results showed that the Amazon Cloud platform has a 38% better performance and cost 43.1% less than current local system.

Giovanni 4

Giovanni 4 includes below new features:

❖ Interactive map, lat-lon map rendered as a WMS (Web Map Service) layer with zoom, pan and color map selection;
❖ Interactive scatterplot, linked to a map of locations of observations;
❖ Interactive Correlation & Time Averaged Difference Maps;
❖ Faster services: Lat-lon map, averaged over time; Time series; Correlation map;
❖ More available data variables;
❖ New User Interface;
❖ Bookmarkable URLs to re-run the exact same workflow in future.
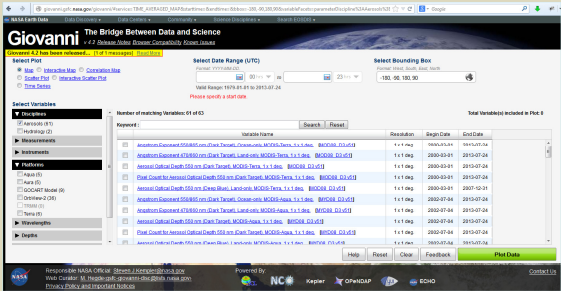
Graphical User Interface of Giovanni 4

Analysis Scenario and Data on Giovanni 4

Scenario: 3-, 6-, 12-, and 24-month area averaged time series of total aerosol absorption optical depth from OMI/Aura are analyzed online via Agile Giovanni.

Platforms: Cloud platform and local operational system
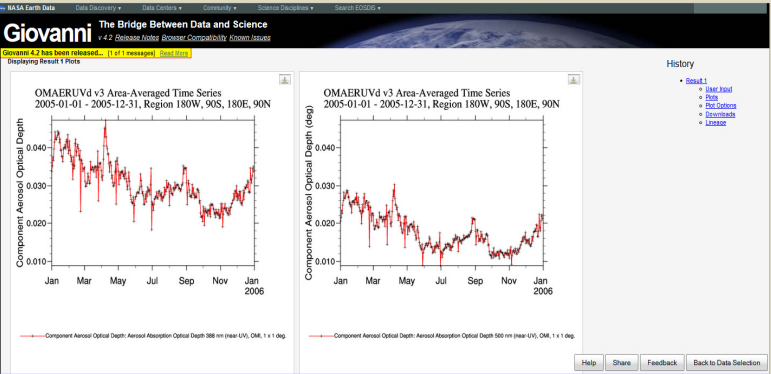
Data used: OMI/Aura

Variable analyzed: Aerosol Absorption Optical Depth (388nm)

Function used: Area-averaged Time Series

Temporal range: 2005.01.01 – 2008.12.31

Spatial range: global

**Pre-cached data**: All data are pre-cached at Cloud platform and local system before analysis.

Online visualization of Time Series analysis of OMI/Aura data

Performance Comparison

	Amazon Cloud	Local System
3 months (6.7GB)	7.5 s	9.7 s
6 months (13.4G)	10.0 s	13.7 s
12 months (27GB)	15.8 s	22.0 s
24 months (54.1GB)	27.3 s	40.0 s

	Cores	CPU (GHz)	RAM (GB)
AWS Cloud Instance	8	2.67	68
Local Operating System	16	2	32

Performance Comparison of Giovanni 4 running on Amazon Cloud and local system
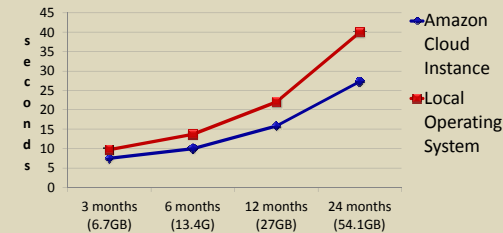
The performance of Giovanni 4 running on Cloud platform is 38% better than running on local system.

For Better Performance: EBS optimized instance and Provisioned IOPS volumes can be utilized.

Cost Analysis of Amazon Cloud vs. Local System

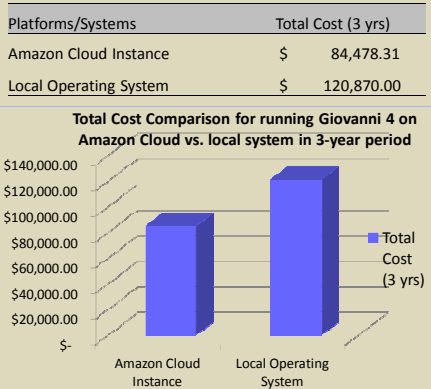| Cloud Platform	Rates	Quantities (3yrs)	Costs (3yrs)
Computing (EC2)	0.82/hr	24*365*3	$ 21,549.60
Storage (S3) (23TB)	0.076/GB-month	23000*12*3	$ 62,928.00
Requests (put/copy/post/list)	0.005/1000	<1000	$ -
Requests (get)	0.004/10000	17659*2*3	$ 0.04
Data Transfer In	0.0/GB		$ -
Data Transfer Out*	0.12/GB	929MB*2*3	$ 0.67
Total			**$ 84,478.31**

Cost details for running Giovanni 4 on Amazon Cloud Platform

Local Server System	Rates	Quantities (3yrs)	Costs (3yrs)
Hardware (Server)	$14,000/each	2	$ 28,000.00
Hardware (RAID)	$13,000/each	2	$ 26,000.00
Maintenance/updating	$85/hr	20(hr/mth)*12*3	$ 61,200.00
Operating cost	$945/each/yrs	2	$ 5,670.00
Others			
Total			$ 120,870.00

Cost details for running Giovanni 4 on local server system

Cost Comparison

In a 3-years period, the cost of running Giovanni 4 on Cloud platform is 43.1% less than the current Giovanni system on local server.

Platforms/Systems	Total Cost (3 yrs)
Amazon Cloud Instance	$ 84,478.31
Local Operating System	$ 120,870.00

Total Cost Comparison for running Giovanni 4 on Amazon Cloud vs. local system in 3-year period

Conclusions and Future Work

A. Migrating a long-term legacy system to Cloud platform is time-consuming and can be costly depending on different applications;
B. Based on GES DISC Giovanni application, Cloud computing provides 38% better performance and costs 43.1% less than current local operating system, mostly because Amazon Cloud has better dedicated servers and lower cost and maintenance fee;
C. Enabling Giovanni 4 elastic on Cloud platform is our priority work in the near future.